Van Duzen River Bridge (Upper Blue Slide Bridge, Bridge No.4-94) HAER No. CA-9
(9 miles east of) Carlotta vic.
Humboldt County
California

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of Interior
Washington, D.C. 20243

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HISTORIC AMERICAN ENGINEERING RECORD

VAN DUZEN RIVER BRIDGE

(UPPER BLUE SLIDE BRIDGE, BRIDGE No. 4-94)

CA-9

Date: 1922

Location: State Highway 36 Spanning Van Duzen River at Post Mile 13.86 approximately nine miles east of Carlotta.

Designed by: John Leonard

Owner: State of California

Significance: This is a highway bridge of open spandrel reinforced concrete deck arch type. It is associated with John B. Leonard - leading proponent and important early designer of reinforced concrete bridges in California. It is also one of only three open spandrel type bridges known to be designed by Leonard. The structure is 464 feet in length, has two 207.5 foot arch spans, and is 20 feet wide.

Transmitted by: Gary R. Arabak, 1983

The Van Duzen River Bridge No. 4-94 is a structure which has integrity of location, design, setting, materials, workmanship, feeling and association. In addition, it embodies the distinctive characteristics of a type (open spandrel reinforced concrete deck arch bridge), period (early 1920's), and method of construction (concrete poured in place); it may be construed to be the "work of a master" -- John B. Leonard, who was a leading proponent of and important early Twentieth Century designer of reinforced concrete bridges in California (and, in at least one instance, in Nevada). It is one of only 3 open spandrel arch bridges known to have been designed by Leonard. It also shows design aesthetics -- complementary arches -- which were still being put forth as "correct" more than a decade later.

During the early 1920's, Route 36 (then known as the Fortuna-Red Bluff Highway) was selected by engineers of the California Highway Commission as the main route between the north coast and the upper Sacramento Valley. It was selected as the most direct route, the easiest to construct and maintain, and the safest to travel. Proceeding inland from Fortuna the road follows the Van Duzen River Canyon to a point about 10 miles above Bridgeville. The Van Duzen, a tributary of the Eel River, because of the mountainous terrain and heavy rainfall of the region, can experience rapid rises and become a major stream at times. Coupled with this, many of the slopes flanking the river along which the highway was built consist of a bluish, serpentine-like material which is slippery and unstable when wet. One point, known as Blue Slide, was regarded as the most dangerous on the Route, as virtually every winter the saturated slope would slide and carry the highway into the river; indeed it was impossible for highway forces to maintain continuous travel during the winter, and several lives were lost. Other portions of the route -- notably Blackburn Grade -- were hazardous due to the combination of steep grades, sharp curves, and precipitous slopes.

Shortly after the aforementioned selection of this route by the CHC Engineers, the Humboldt County Board of Supervisors began a road improvement program. As part of this program, five bridges were constructed -- two in 1923 to eliminate the Blue Slide, and three in 1925 to eliminate the Blackburn Grade and to replace a covered bridge at Bridgeville (See Exhibits C and D). All five bridges were designed by John B. Leonard, a consulting engineer from San Francisco who was an important early 20th Century designer of and proponent of reinforced concrete bridges of California.

John B. Leonard was born in Union City, Michigan on July 18, 1864. His education was in the public schools of Union City, at Michigan State College, at Illinois University, and at the University of Michigan. Leonard earned his own way through college doing various jobs, including teaching.

In 1888 he moved to Los Angeles where he worked in that City's engineering department. In 1889 he came north to San Francisco and spent the rest of his life in the Bay Area. In 1889 and 1890 he was employed by the American Bridge and Building Company; from 1891-1894 by the firm of Bigelow and Little, proprietors of the Bay City Iron Works. 1895 found him in the employ of the Southern Pacific's maintenance-of-way department. In 1896-1897 he worked for the Pacific Rolling Mill. He first appears as an independent engineer in 1898-1899, specializing in concrete and artificial stone. From 1900 to 1903 he served as chief engineer for Healy, Tibbits and Company, builders of wharves, bridges, and railroads. From 1904 through 1928 he is again independent as a consulting civil and structural engineer, and it is during this period that his most notable work in bridges is accomplished.

Leonard was in the right place, at the right time, to have been aware of the great potential of reinforced concrete as the material of the future. The year of his arrival in San Francisco (1889) also saw the completion of Ernest L. Ransome's Alvord Lake Bridge in Golden Gate Park. This was the first reinforced concrete bridge in the United States (and still in use). While it may never be known precisely when Leonard became committed to reinforced concrete bridges, one can see that by 1898-99, he has an awareness, and his various employments would also have familiarized him with bridge engineering in general, and with steel bridge engineering (and the limitations thereof) in particular. From 1906 through January 1912, and again in 1924, he served as associate editor (on reinforced concrete) of Architect and Engineer of California. During the first period Leonard authored a number of articles touting the qualities of reinforced concrete, and had photos of some of his bridges appear in these as well as in articles by others. Research also shows that Leonard carried his commitment to reinforced concrete beyond designing bridges: from about 1906 to 1912 he was a sales agent for "corrugated bars for reinforced concrete", and from 1913 to 1917 was sales manager for Pacific Coast Steel, a major supplier of reinforcing steel. Exhibit E shows an example of his advertisements which is (as was typical) illustrated with a photo of one of his bridges.

Following his departure from Architect and Engineer of California in 1912, Leonard and then-partner W. P. Day in 1913 published a book entitled The Concrete Bridge: How it Has Proved Itself In California. In this, the qualities of reinforced concrete for bridge building were again extolled. The various types of these bridges -- flat spans (girder type and girdless), filled spandrel arches, open spandrel barrel vault arches, open spandrel rib-type arches -- are discussed. Also mentioned is the fact that these bridges utilized local California products -- timber for falsework and forms, cement, aggregate, sand, reinforcing steel -- and thus avoided the delays which often accompanied the building of steel bridges due to the need to ship components in from out-of-state. The book then goes on to illustrate no fewer than twenty of Leonard's bridges, about which Leonard calls the reader's attention to the "pleasing spring of the arch". His designs reveal a concern for aesthetics, for fitting the design to the site, and for detail. His arch bridges, without exception, reveal graceful parabolic arches rising to a remarkably thin section at the apex. They were used singly or in multiple arch spans as his landmark Fernbridge over the Eel River in Humboldt County. This book is also singularly unique in that it carries on, in bridge engineering, a tradition of practicing architects to publish pattern books. While Leonard was not an architect, and while this was not literally a pattern book, its relation to this tradition -- which dates back at least to the 16th Century Italian architect Palladio -- is clear. This tradition was not without precedent in California either, as the 19th Century architects Samuel and J. Cather Newsom published no fewer than eleven pattern and other books promoting their design and services. Leonard, however, appears to have been the only consulting engineer of this period to use this approach, and this book remains unique for providing a capsule glimpse of reinforced concrete bridge design in the first decade-and-a-half of the 20th Century. It is likewise a fine encapsulation of the earlier designs of John B. Leonard.

The Leonard & Day partnership apparently was terminated about 1918, and Leonard is listed variously as a structural or a civil engineer in San Francisco city directories from 1919 to 1928. In 1921-22 he participated in work at the test highway in Pittsburg, California where he furnished the delicate instruments necessary for measurements. This test highway was notable in that it was one of only two such test roads in the U.S. built with private funds (this one financed by Columbia Steel Company); all other research effort fell upon the U. S. Bureau of Public Roads. In the early 1920's, Leonard took on Harold B. Hammill as a new junior partner. Leonard, in association with Hammill, was instrumental in devising a method of analyzing an arch by the ellipse of elasticity. This development, which occurred about 1923, was claimed by both men to be quick and

accurate. It was during his period of association with Hammill that Leonard designed the five bridges on the Fortuna-Red Bluff Highway with Hammill assisting on at least three of the five.

On May 18, 1928 Leonard was appointed Superintendent of Building Inspection in San Francisco, a position he held until 1934. In 1935 he returned to private practice as a consulting civil and structural engineer, in which capacity he continued until his death on February 16, 1945 at the age of 80.

Leonard's pioneering efforts in reinforced concrete bridge design have not gone unnoticed. Two of his bridges have been designated Historic Civil Engineering Landmarks by the American Society of Civil Engineers. These are the aforementioned Fernbridge, and the former Mountain Quarries Company railroad bridge over the American River below Auburn, California. The A.S.C.E. recognized the 1911 Fernbridge -- 2,408 feet long with unprecedented 180-foot arched main spans -- as providing precedent for the 1913 Colorado Street Bridge over Arroyo Seco in Pasadena and the 1914 Cabrillo Bridge in San Diego. And the railway bridge was, when built in 1911, the longest span concrete arch railroad bridge owned by a private concern. Further, the Keeper of the National Register of Historic Places has determined the only known non-reinforced concrete bridge designed by Leonard to be eligible for inclusion in the National Register of Historic Places. This latter is a steel Pratt truss swing bridge spanning the Sacramento River between Glenn and Butte Counties, California. Significantly, Leonard's first proposal for this location was a reinforced concrete bridge. Only after this had been turned down by the joint boards of Supervisors of the two counties, who also called for a steel bridge, did the present design evolve.

In mentioning Leonard's significance in the field of engineering, it must be noted that there is evidence that he played an important role in the reconstruction of San Francisco following the 1906 earthquake and fire, though details of that role are not known at this time.

IX. Bibliography

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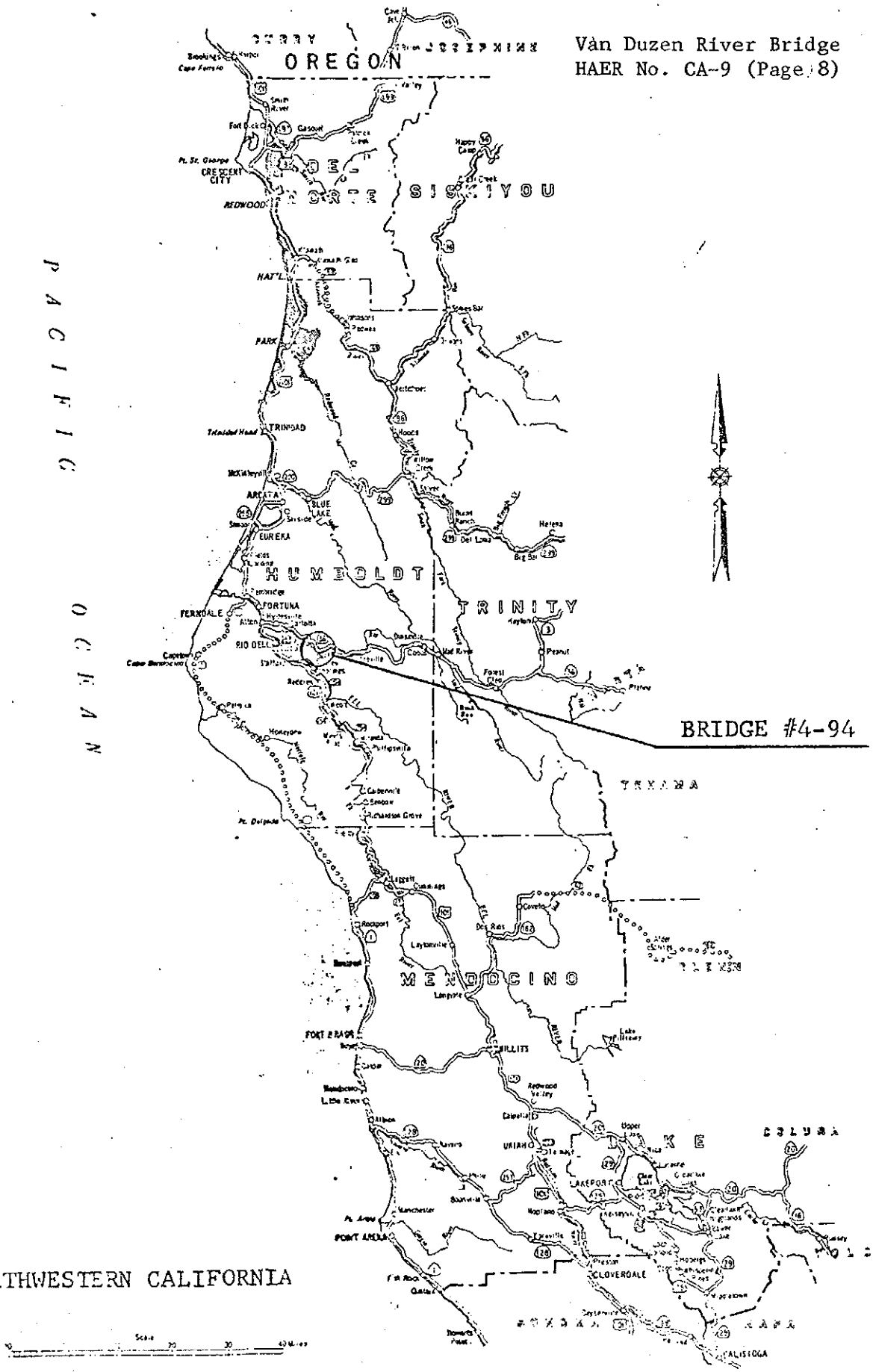
X. Exhibits

Vàn Duzen River Bridge
HAER No. CA-9 (Page 8)



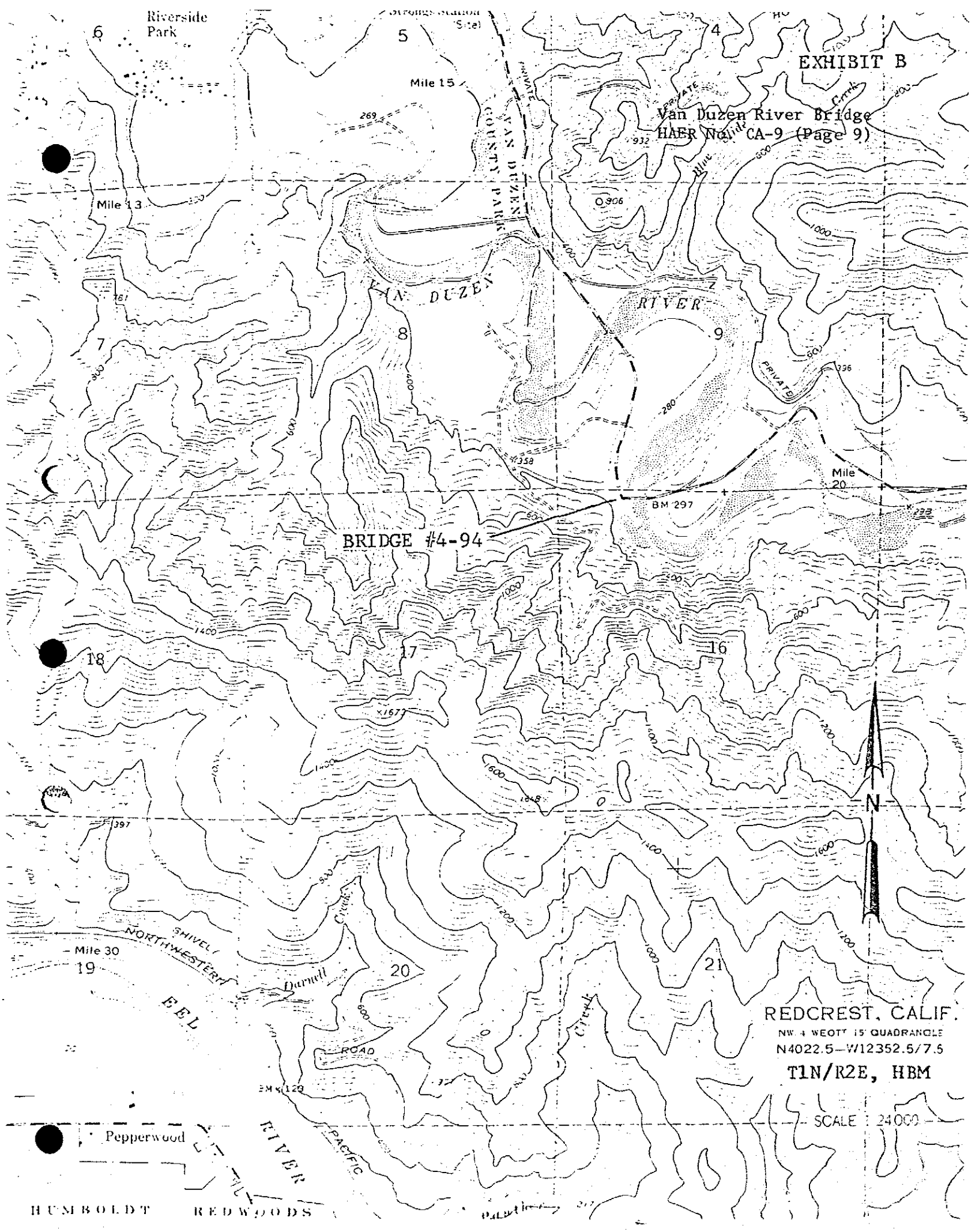
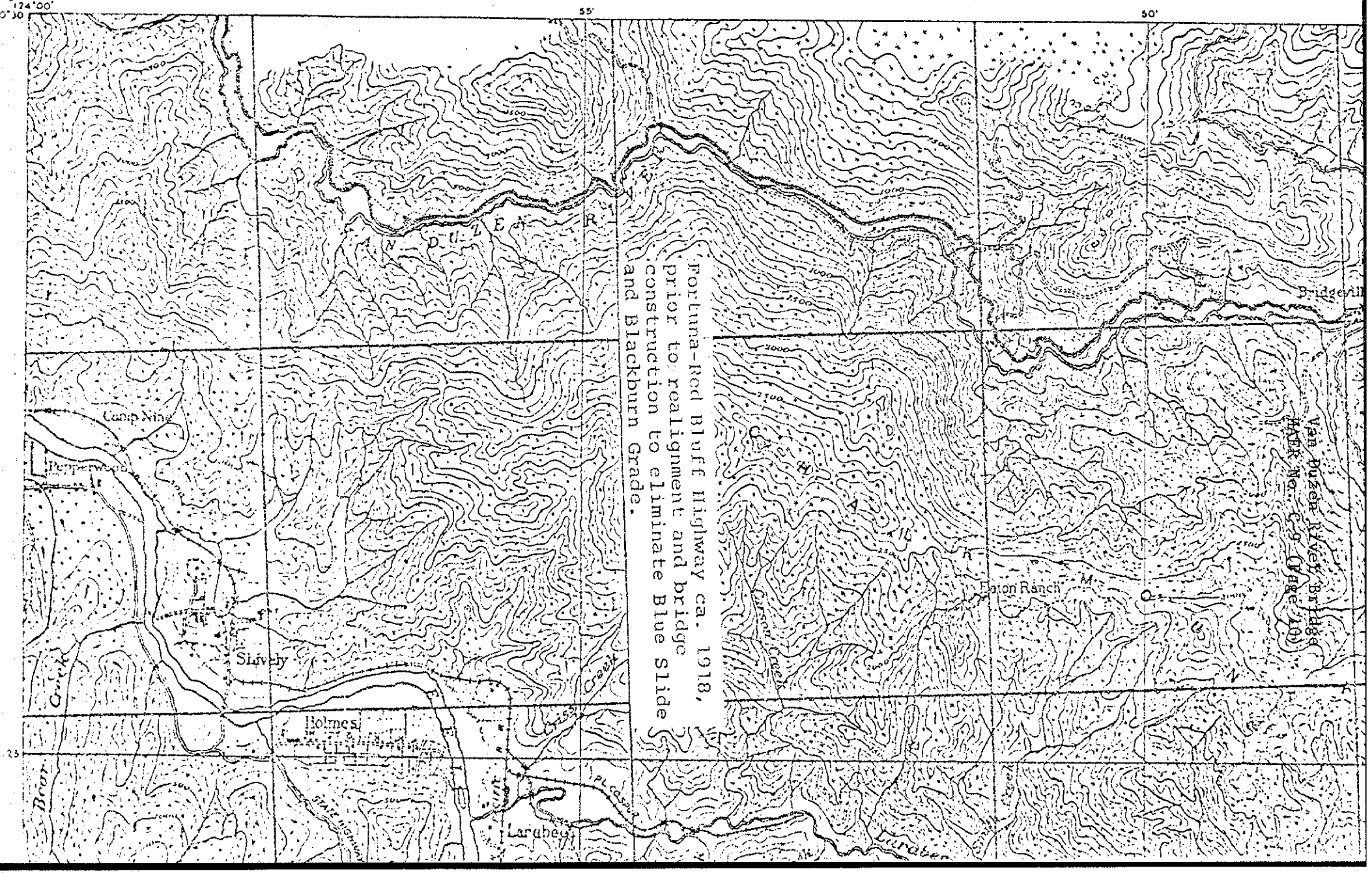


EXHIBIT B
Van Duzen River Bridge
HAER No. CA-9 (Page 9)
BRIDGE #4-94
Riverside Park
Mile 15
Mile 13
Mile 20
Mile 30
VAN DUZEN RIVER
COUNTY PARK
PRIVATE
BM 297
N
REDCREST, CALIF.
NW 4 WEOTT 15' QUADRANGLE
N4022.5—W12352.5/7.5
T1N/R2E, HBM
SCALE 1:24000
Pepperwood
HUMBOLDT REDWOODS
EEL RIVER
PACIFIC
NORTHWESTERN
SHIVELY
Daniell Creek
ROAD

CORPS OF ENGINEERS, U. S. ARMY
TACTICAL MAP

CONTROLLED RECONNAISSANCE

18-S-1-W/2



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

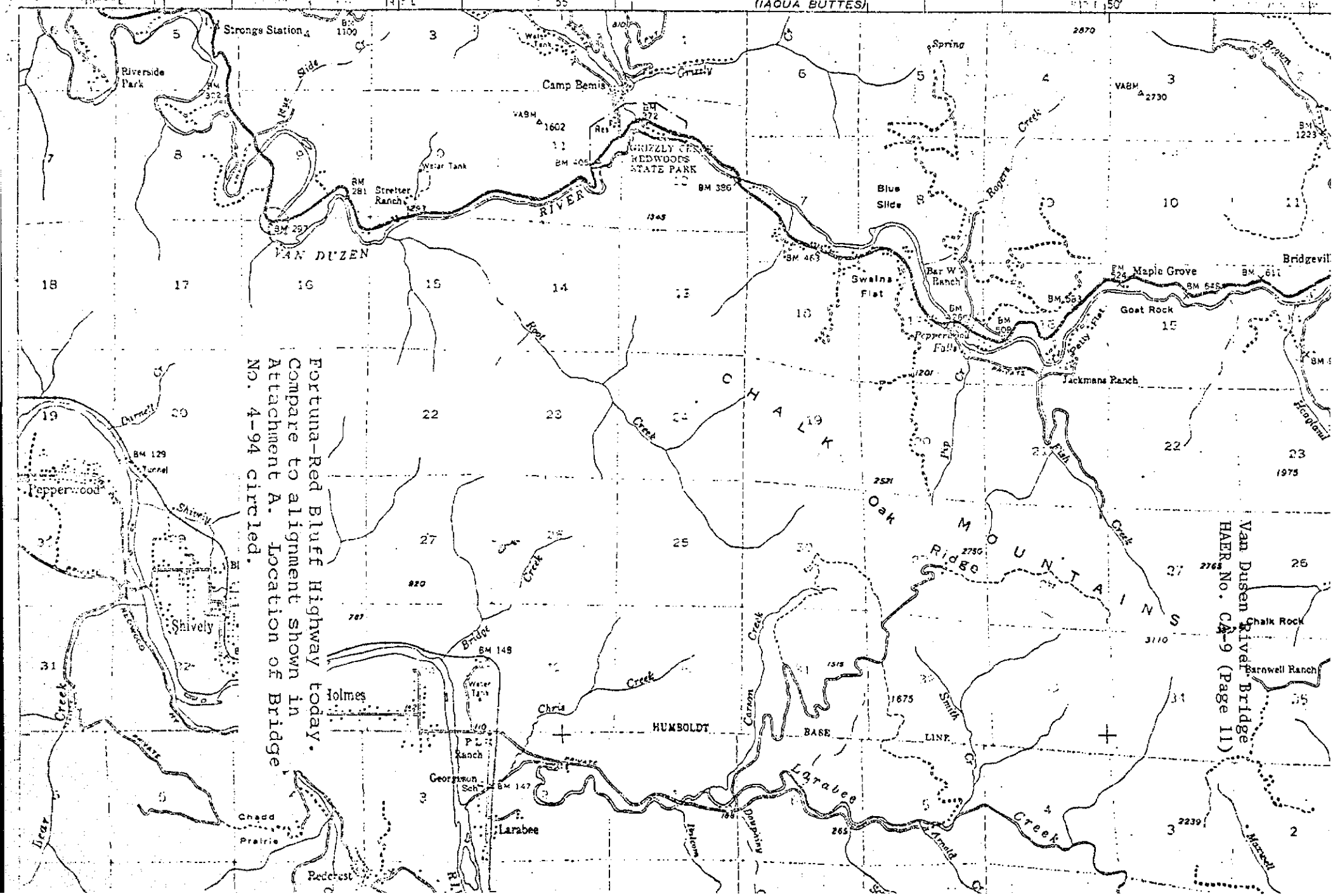
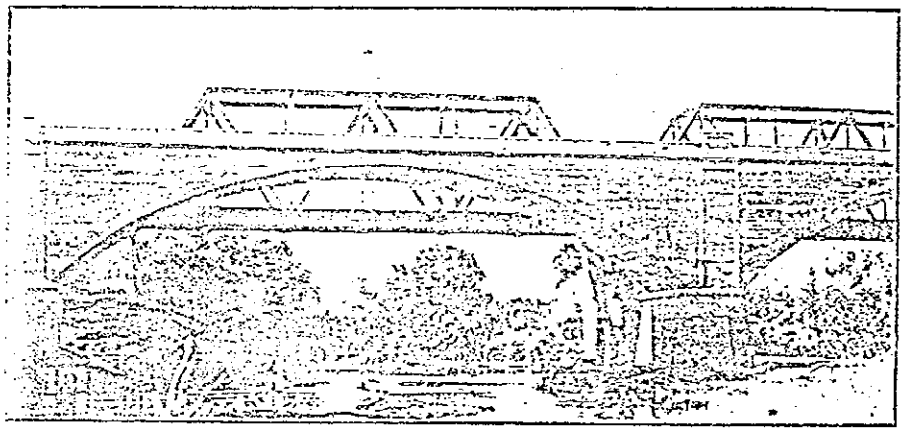
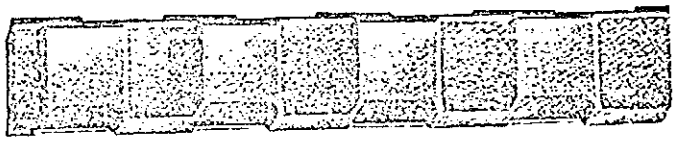


EXHIBIT E



Two Reinforced Steel Arches 100 Feet Spans Each, Crossing Stanislaus River Near Ripon, Cal., Reinforced with Corrugated Bars, Designed By John B. Leonard C. E.



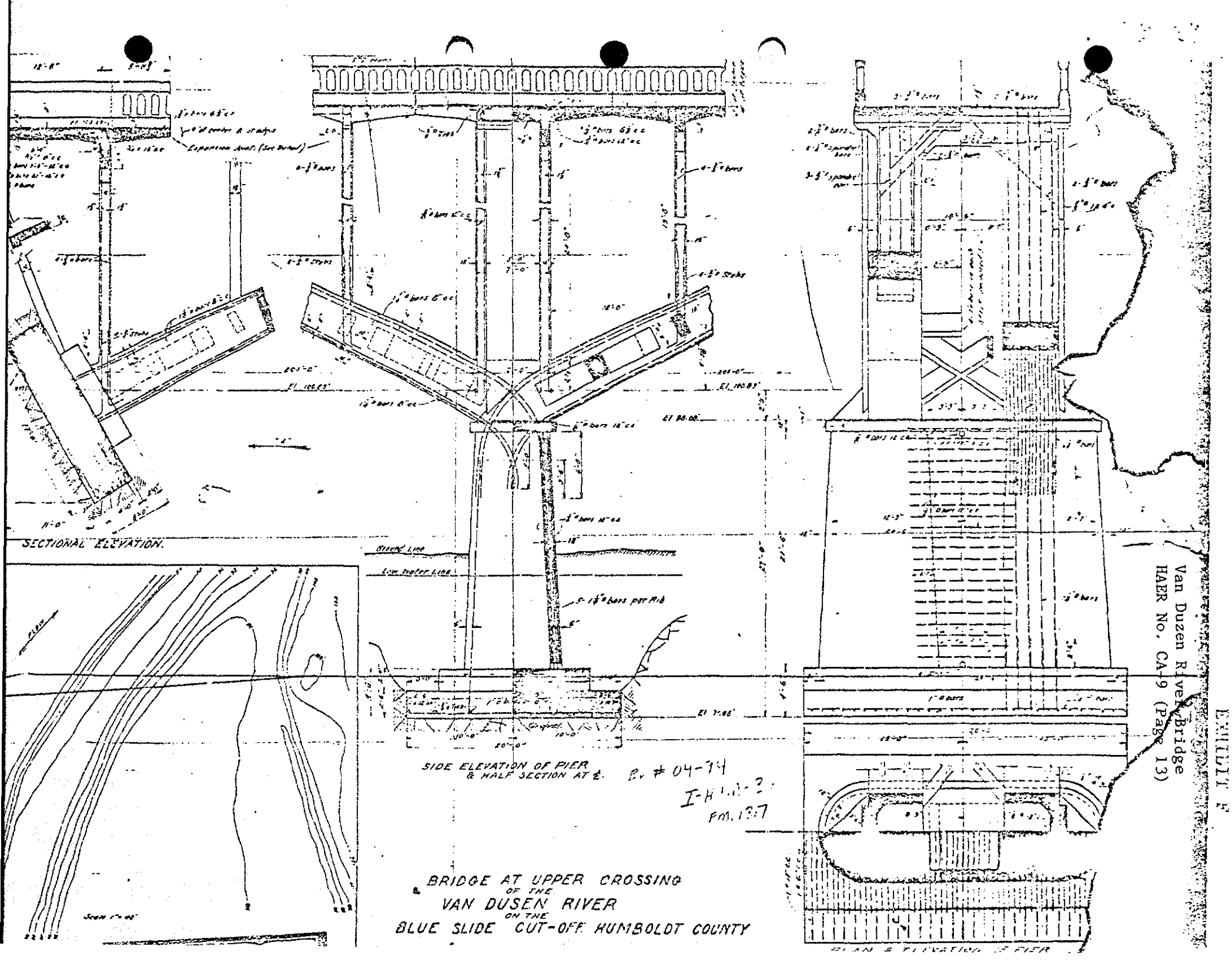

SECTIONAL ELEVATION.
SIDE ELEVATION OF PIER & HALF SECTION AT ℄.
BRIDGE AT UPPER CROSSING OF THE VAN DUSEN RIVER ON THE BLUE SLIDE CUT-OFF HUMBOLDT COUNTY
Van Duzen River Bridge
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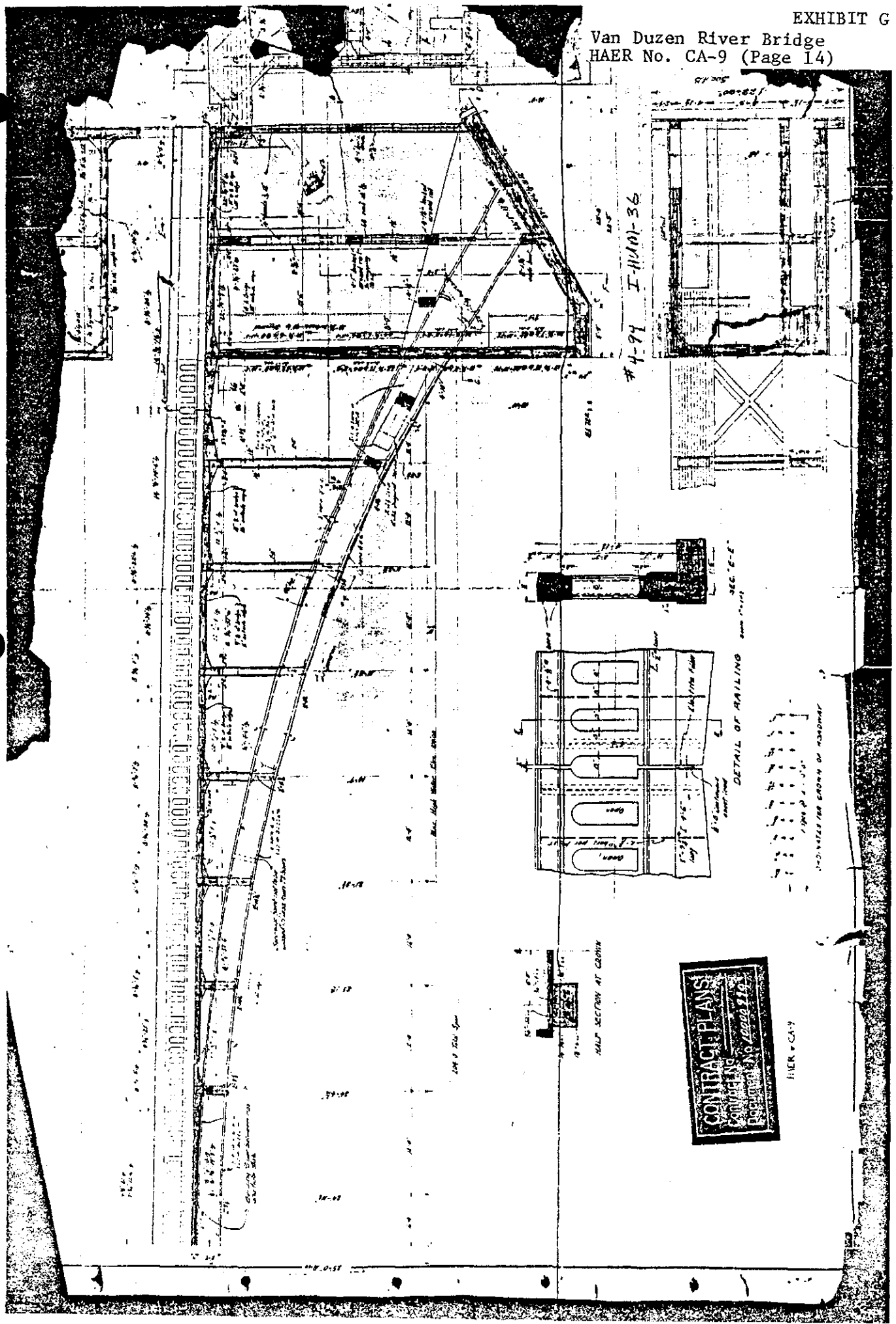
EXHIBIT G
Van Duzen River Bridge
HAER No. CA-9 (Page 14)



XL. Individuals Compiling Documentation

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